March 28, 1950 F. B. YINGLING 2,501,805

ROTARY MIXER

Filed May 18, 1946 3 Sheets-Sheet 1

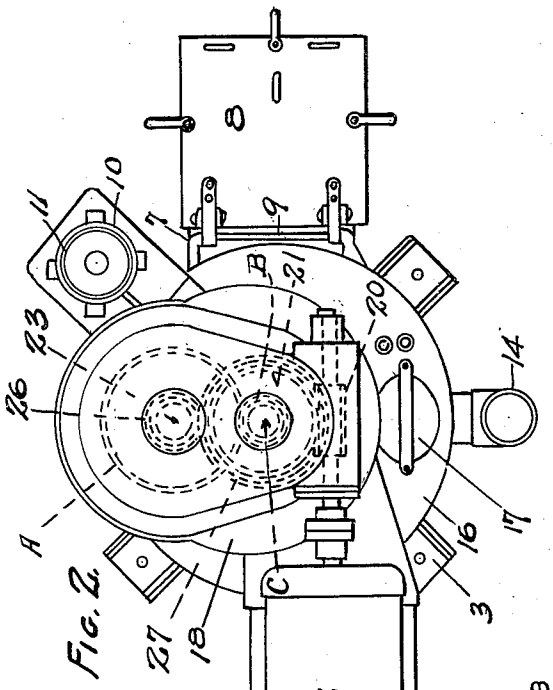


FIG. 2.

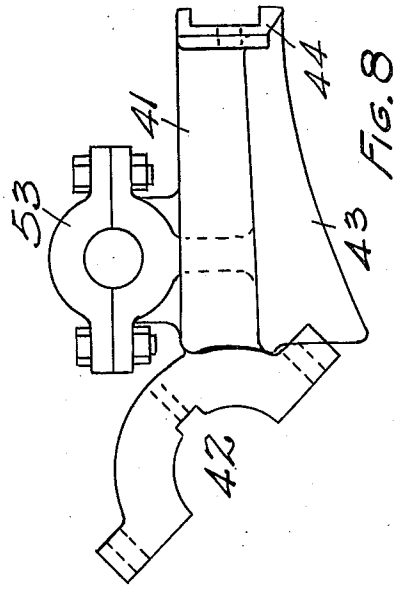


FIG. 8.

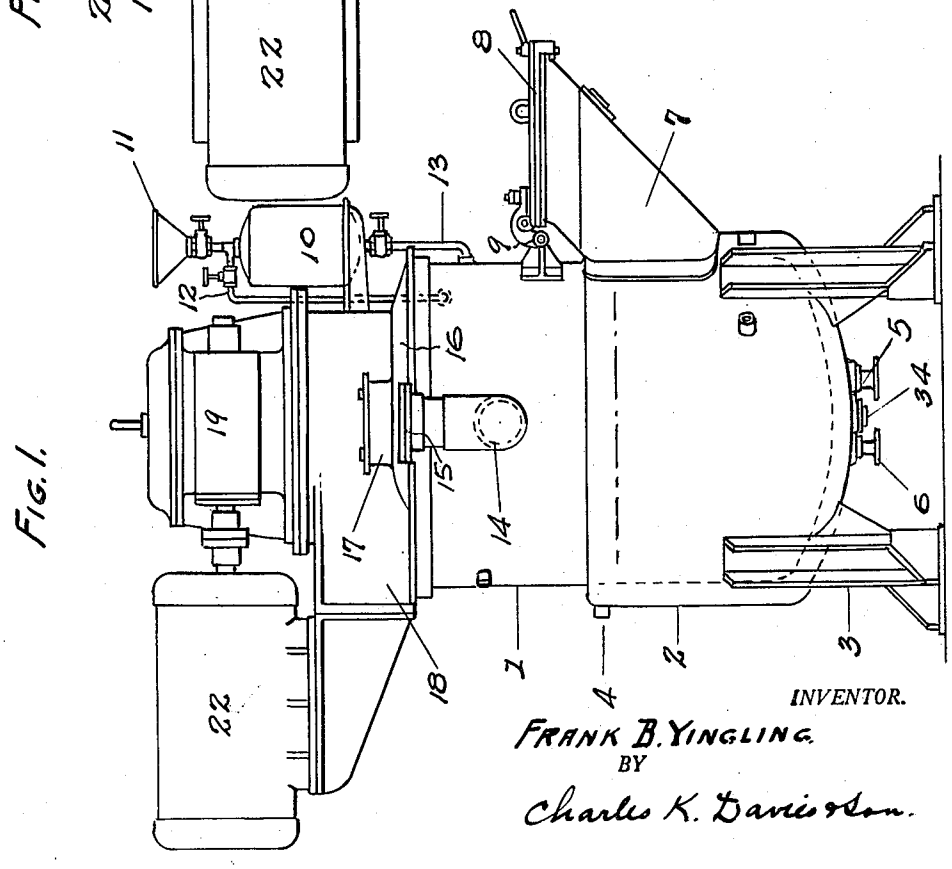


FIG. 1.

INVENTOR.

FRANK B. YINGLING

BY

Charles K. Davis & Son.

March 28, 1950 F. B. YINGLING 2,501,805

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Filed May 18, 1946 3 Sheets-Sheet 2

FIG. 3.

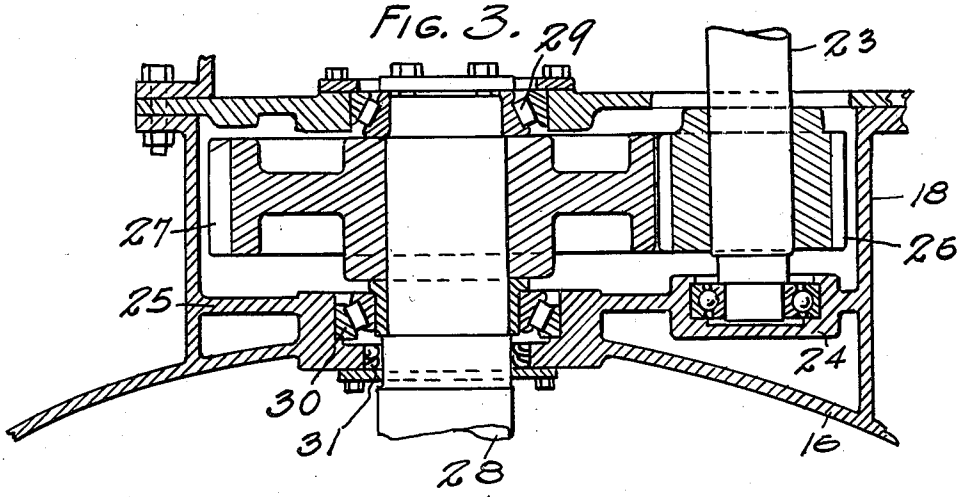
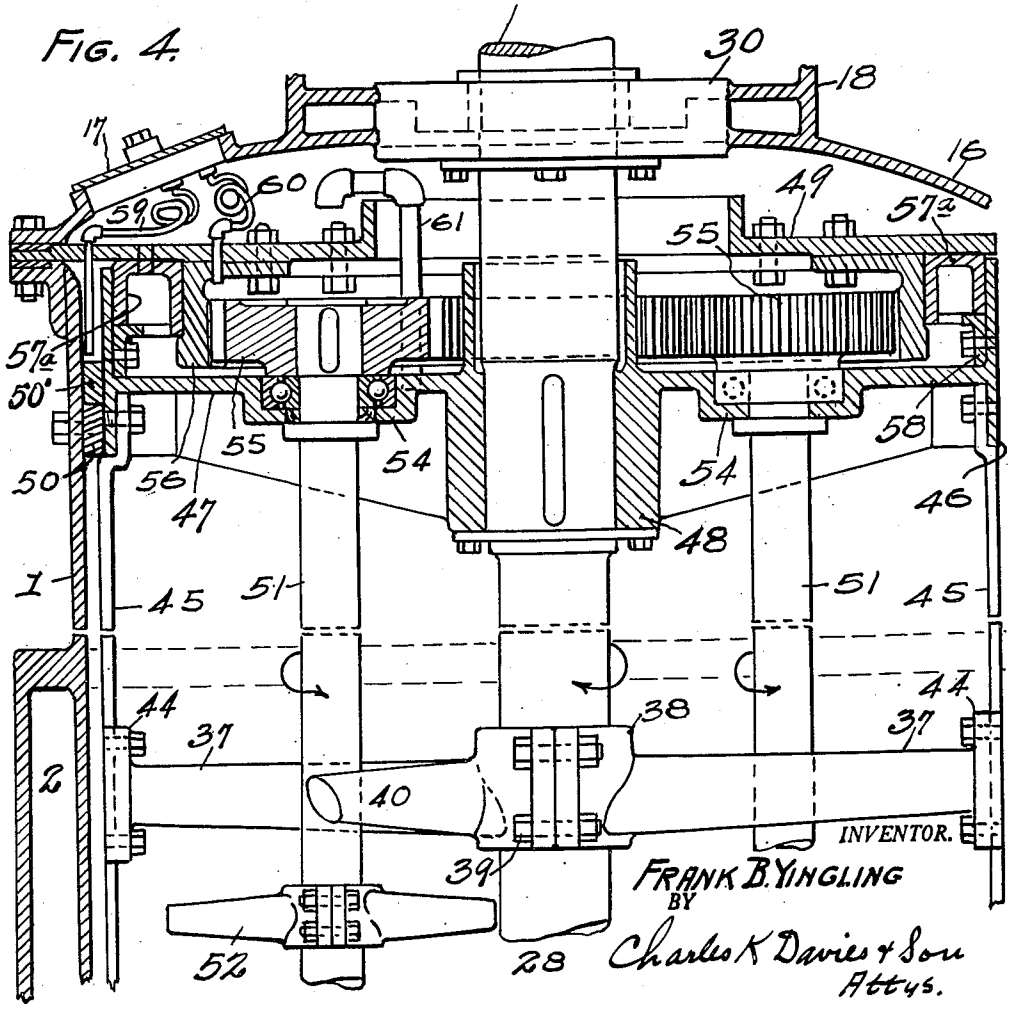


FIG. 4.



INVENTOR.
FRANK B. YINGLING
BY
Charles K Davies & Son
Attys.

March 28, 1950 F. B. YINGLING 2,501,805

ROTARY MIXER

Filed May 18, 1946 3 Sheets-Sheet 3

FIG. 6.

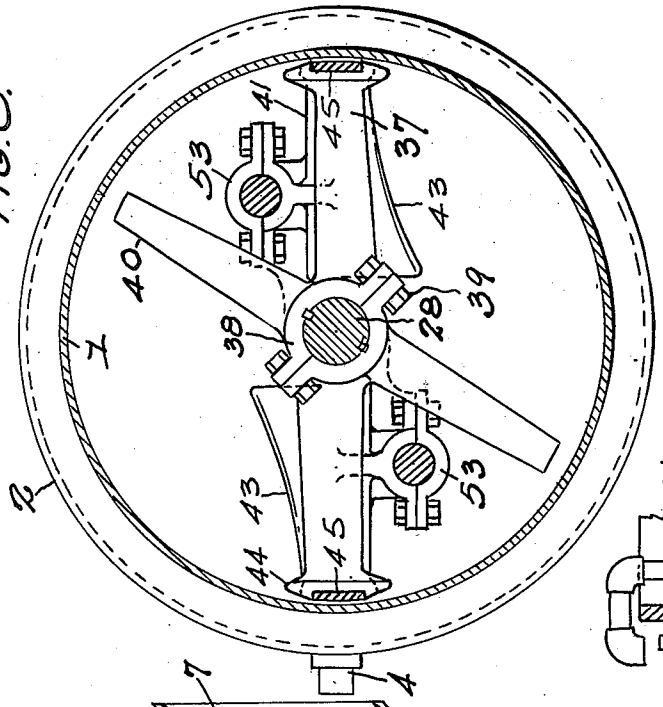


FIG. 7.

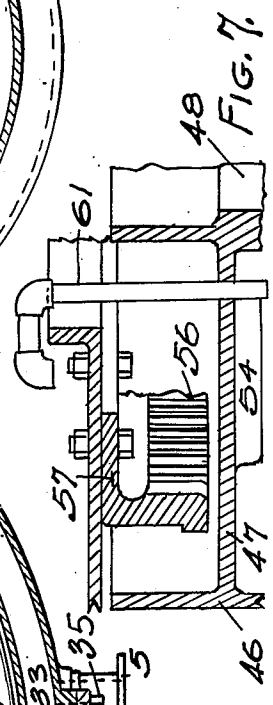
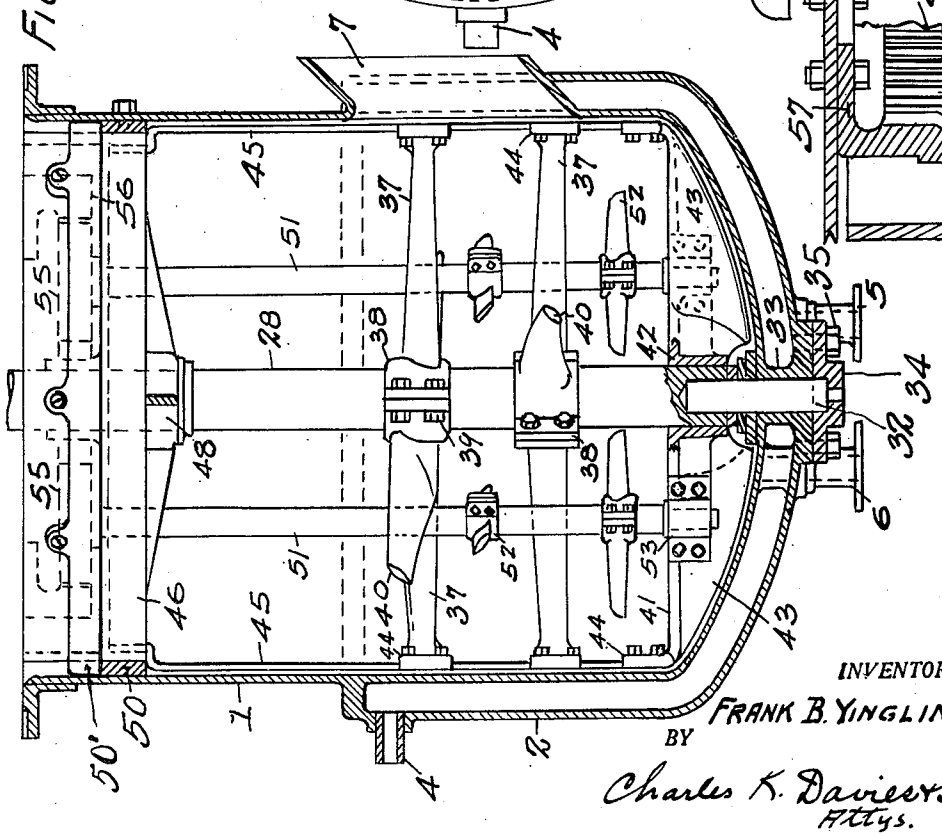


FIG. 5.



INVENTOR.
FRANK B. YINGLING
BY
Charles K. Davies & Son
Attys.

Patented Mar. 28, 1950

2,501,805

UNITED STATES PATENT OFFICE

2,501,805

ROTARY MIXER

Frank B. Yingling, Hamilton, Ohio

Application May 18, 1946, Serial No. 670,758

4 Claims. (Cl. 259—102)

1

The present invention relates generally to improvements in rotary mixers of the power operated type, and while the invention provides mechanical structures adapted for various purposes, it is especially designed for converting solids into liquids. In one of its specific uses the invention has been embodied in a mixer for processing excess paint in semi-solid or solid form that has been reclaimed by air currents from the spraying booths in which automobiles are painted.

In carrying out my invention, the reclaimed paint in semi-solid or solid form is fed to the mixer, and in the presence of a liquid solvent, the solids are finely comminuted, rapidly dissolved, and converted into a liquid state for subsequent treatment and use.

Air under pressure may be supplied to the mixer from a compressor, or a vacuum condition may be created within the sealed mixer by means of a suitable pump, to suit different conditions encountered in the dissolution of the solid materials.

The primary object of the invention is the provision of a mixer employing a stationary receptacle or tank together with power operated rotary agitators and stirrers, in which the component parts may readily be manufactured and assembled to insure simplicity in construction and efficiency in operation. To assure facility in maintaining the appliance in mechanically correct working condition, I employ cutter blades, stirrers, paddles and scrapers, that are readily removable without the necessity for disturbing the other portions of the mechanism.

The invention consists in certain novel combinations and arrangements of parts involving a fixed tank and a power operated rotary impeller that includes cutters, agitators, and stirrers, as well as scrapers, together with other component parts as will hereinafter be more fully set forth and claimed.

In the accompanying drawings I have illustrated one complete example of the physical embodiment of my invention in which the parts are combined and arranged according to one mode I have thus far devised for the practical application of the principles of my invention. While the present disclosure has proven satisfactory in service, it will be understood that changes and alterations may be made in the exemplifying drawings and mechanical structures, within the scope of my appended claims, without departing from the principles of my invention.

Figure 1 is a view in elevation of a power operated rotary mixer in which my invention is physically embodied.

2

Figure 2 is a top plan view of the mixer of Fig. 1.

Figure 3 is an enlarged detail vertical sectional view showing part of the reduction gearing for the rotary impeller.

Figure 4 is a vertical sectional view through the operating head of the tank, just below the structure of Fig. 3, showing the planetary drive for the stirrers, the main drive shaft, and other parts of the impeller construction.

Figure 5 is a vertical sectional view of the tank showing the relation of the impeller unit to the intake or feed hopper, and the removable bearing of the impeller shaft.

Figure 6 is a horizontal sectional view through the tank showing one of the agitators, the main and stirrer shafts in section, and the bottom scrapers within the tank.

Figure 7 is a fragmentary detail vertical sectional view illustrating the equalizing or balancing tube between the tank proper and its upper gear casing.

Figure 8 is an enlarged top plan view of a half-section of the bottom scraper.

In the two exterior assembly views of Figs. 1 and 2, is shown a cylindrical tank 1 having a concave bottom and dome shaped top, and an exterior steam jacket 2 surrounds the lower portion of the tank. The tank is supported in elevated position by legs or brackets 3, and steam from a suitable source is admitted through nipple 4 to the steam jacket for heating the interior of the tank, an outlet being indicated at 5 at the bottom of the jacket, and another outlet 6 being shown for the tank.

For feeding semi-solid or solid material by gravity to the interior of the tank a chute or hopper 7 is arranged at one side thereof, and the hopper is made airtight and liquid tight by means of a sealed cover 8 that is hinged at 9, and clamped with suitable fasteners and gaskets to provide a closure after the material has been dumped into the hopper.

A liquid solvent is supplied by gravity flow from an elevated expansion tank 10 of suitable capacity, which may be filled through the funnel 11, and feed pipes 12 and 13 for selective use under control of usual valves, are connected to the interior of the upper portion of the tank to supply the liquid solvent, the level of which is indicated in Fig. 1 by the dotted dash line.

For supplying air under pressure to the interior of the tank, or for use in creating a vacuum condition within the tank, an elbow connection is

shown at 14, which is provided with a coupling 15 that is utilized for connection to an air pump; and the dome shaped cover 16 of the tank has a sealed manhole 17 that is openable for access to the interior of the tank.

Above the tank cover is mounted a speed reduction casing 18, and a gear housing 19, the latter enclosing a worm and pinion drive 20, 21, to which power is supplied from an electric motor 22 mounted on brackets supported from the upper part of the tank, and at one side thereof.

In dotted lines Fig. 2, an optional pair of speed reduction gears A and B are shown as driven from the gear 21, driven gear A being mounted on a short vertical shaft 23 and drive gear B, being mounted upon another short shaft C axially alined with the vertical axis of the tank.

In the enlarged sectional view Fig. 3, the vertical shaft 23 of the pinion 26 in Fig. 2, is journaled in bearings 24 of the horizontal bearing plate 25 of the casing 18, and a further reduction in the transmission of speed from the motor is attained through the driving pinion 26 on short shaft 23 and a driven gear 27, that is rigidly mounted on the main impeller shaft 28, the upper end of which is journaled in roller thrust bearings 29 and 30 of the gear housing.

The impeller shaft 28 depends from its lower supporting bearing 30, which is sealed as at 31, and the shaft extends vertically down through the central part of the tank. In Fig. 5 it will be seen that the lower end of the shaft 28 within the tank is provided with a socket end, that revolves upon the upper end of a fixed stud shaft 32, which is removable and extends up through a tubular boss 33 between the bottom of the tank and the bottom of the steam jacket. The lower exterior end of the stud shaft is secured upon an exterior flanged plate 34 that is bolted at 35 to an enlarged exterior head on the bottom of the steam jacket.

The rotary impeller assembly is mounted upon the central shaft 28 to revolve therewith, and as best seen in Fig. 5, the assembly includes plural cutters, agitators, stirrers, and scrapers, the numbers employed being variable to suit different conditions.

As here shown I employ two sets of agitator units each including a pair of diametrically arranged horizontal cross braces or arms 37, each arm integral with a hub-section 38, and the hub sections are rigidly clamped upon the impeller shaft, as by bolts 39. Integral with each cross arm or spoke 37 I provide an agitator blade 40 that projects radially from the hub section, and it will be noted that the hub sections are divided on lines that permit convenient manipulation of parts in assembling, as well as in dismantling the units. The agitator blades 40 are preferably staggered in their relationship, and, together with the cross arms or spokes 37 they revolve within the tank below the liquid level, to assist in the dissolution of the solid material being fed through the hopper or chute 7.

On the lower end of the main impeller shaft or agitator shaft 28 a bottom scraping unit is mounted to prevent accumulation or collection of sediment or solids, and this scraping unit, which forms part of the impeller assembly includes a two-piece structure made up of diametrically extending arms 41 each having an integral semi-circular hub section 42 that are bolted about the impeller shaft 28 similar to the hub sections 38.

As seen in Figs. 5, 6, and 8 the scraper unit is provided with two scraping blades 43, conforming

to the concave bottom of the tank, and these blades revolve with the impeller assembly to clear the bottom of the tank from any accumulation of material.

Each of the cross arms 37 and 41 at their outer ends terminate in recessed heads 44, and these two alined sets of attaching heads are bolted to two diametrically arranged vertical cutter bars 45 having cutting edges and which pass across the inlet opening of the hopper or chute as the impeller assembly revolves within the tank.

The upper ends of the cutter bars are bolted within the lower flange of a cylindrical impeller head 46, and the horizontal plate 47 of this rotary head is fashioned with a hub 48 that is keyed on the impeller shaft or drive shaft 28 to revolve therewith.

The rotary impeller head is located in the upper part of the tank directly beneath a circular flat head-plate 49, which is rigidly bolted, with asbestos gaskets, between the flanged upper end of the tank and its dome shaped cover, and the annular space between the tank and the rotary head is closely sealed by means of a fixed ring 50 and a floating ring 50'. The ring 50 is bolted to the inner surface of the tank, and the floating ring 50' is located above the fixed ring, and mounted by lugs and bolts upon the exterior surface of the impeller head 46. This arrangement of the fixed and floating rings eliminates the possibility of fumes solidifying between the rotating head 46 and the interior of the tank.

In addition to the rotary agitators of the impeller, stirrers are also mounted in the impeller assembly to revolve with the impeller and to rotate relatively thereto, and planetary gearing is employed for the relative rotation of the stirrers. For this purpose two diametrically arranged stirrer shafts or beater shafts 51 disposed parallel with the main impeller shaft are provided with beaters or paddles 52 having hub-sections clamped by bolts upon the shafts, and in Fig. 6 the lower ends of the stirrer shafts are journaled in bearings 53 integral with the sections of the bottom scraper unit.

The upper ends of the stirrer shafts 51 are journaled in bearings 54 of the gear plate 47 of the impeller head, and above this plate planetary pinions 55 are keyed on the two shafts. These planet pinions mesh with an internal gear ring 56 that is stationary and provided with an inner attaching flange 57 that is bolted to the under face of the fixed head plate 49, in order that power may be transmitted from the revolving impeller head to the planetary gears and thence to the stirrer shafts and stirrers.

The annular space between the fixed internal gear ring and the upper flange of the impeller head, and beneath the head plate 49, is provided with an optional semi-steel floating seal ring 57*a* that rests upon a flanged bronze ring or seat 58 which is bolted to the inner face of the rotary impeller head above the gear plate 47. The fixed ring 50 and the floating ring 50' (together with the optional ring 57*a*, when it is employed) form a liquid and air joint between the tank space and the head space to prevent access of fumes and vapor to the operating parts of the impeller head, which, upon condensation, would interfere with the smooth operation of the parts.

The operating parts of the appliance are properly lubricated, as by means of an oil pipe 59 for the seal rings 50 and 50', and the planetary gearing is lubricated with oil from pipe 60.

In order to balance and equalize air pressure,

or a vacuum effect, within the interior of the appliance and its sealed portions a balancing or equalizing pipe 61 is mounted, as in Fig. 7, in the plate 47 of the impeller head, with its lower end open to the interior of the tank and its upper angular end open to the interior of the dome of the tank as well as to the interior of the impeller head.

The solvent in liquid form is supplied to the interior of the tank; and the semi-solid or solid material is supplied to the open hopper or chute in suitable manner, after which the cover of the hopper is closed and sealed, and the semi-solid or solid material is then fed by gravity down the inclined chute and through its intake opening. With the mixer in operation, the vertical cutters of the rotary impeller passing the intake opening slice off the solid material in comminuted portions, and these portions are whirled around in the tank, uniformly distributed to facilitate dissolution, and the mixture is thoroughly agitated and stirred to produce a fluent or liquid state that permits drainage of the tank in suitable manner for subsequent treatment and use of the recovered product.

The cutters, agitators, stirrers, and scrapers, all jointly co-act to produce the required conditions within the tank for rapid, efficient, and thorough dissolution of the solid material. It will be noted that the quick-detachable parts forming the interior cutting, stirring and scraping mechanism and shaft bearing are so combined and arranged that they can readily be assembled and. when necessary, they may also be dismounted within the tank without necessity for removal of the driving and other operating mechanisms. While I have in the present instance shown and described a preferred embodiment of my invention that has produced satisfactory and reliable results, changes and modifications are contemplated in this disclosure within the scope of my appended claims, without departing from the principles of my invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an impeller assembly for a solvent tank having a removable stud-shaft mounted in the bottom of the tank, the combination with an impeller shaft alined with and mounted on the stud-shaft within the tank, and bearings for the upper end of the shaft mounted in the tank, of an impeller-head rigid with the shaft, agitator units mounted on the shaft, a pair of cutter bars vertically disposed and rigidly mounted between said head and the lowest agitator unit for co-action with a lateral feed opening in the tank, a pair of stirrer shafts journaled at their lower ends in said lowest unit, a plurality of stirrer units mounted on the stirrer shafts, and planetary gearing for transmitting power from the impeller shaft to the stirrer shafts.

2. In a rotary mixer for dissolving solids in fluids the combination with a tank having an interior fixed seal-ring and a rigid head plate, of a rotary impeller including a cylindrical impeller head frictionally engaging said seal-ring, a gear plate rigid with the head, an internal gear ring rigid with the head plate, a floating seal-ring mounted between the gear ring and the impeller head beneath the head plate, an impeller shaft rigid with the impeller head, a pair of stirrer shafts journaled in the gear plate, planetary gears on the stirrer shafts engaging the gear ring, and means for revolving the impeller shaft.

3. In a rotary mixer for dissolving solids in fluids, the combination with a closed and sealed tank and an impeller having a cylindrical impeller head mounted in the tank, of a fixed seal-ring mounted between the tank and the exterior of said head, a gear-plate rigid with the head and planetary gears journaled in said plate, a head plate closing the upper end of the tank and an internal gear ring rigid with the under face of said plate, a floating seal-ring mounted in the annular space between the gear ring and the impeller head beneath said head plate, and a pressure equalizing pipe mounted in the gear plate opening at its ends to the interior of the tank and above the head plate.

4. In a rotary mixer, the combination with a tank having a lateral feed opening, a removable bottom stud-shaft, of an impeller including a rotary head and shaft detachably journaled on the stud-shaft, agitating units mounted on the shaft and detachable within the tank, cutters mounted on said head and units, a bottom-scraper detachably mounted on the shaft, rotary stirrers detachably mounted on the scraper and head, and means for transmitting power from the impeller shaft to the rotary stirrers.

FRANK B. YINGLING.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
19,610	Perry et al.	Mar. 9, 1858
374,706	Rosenkranz	Dec. 13, 1887
634,999	Schaaf	Oct. 17, 1899
901,465	Pancoast	Oct. 20, 1908
1,156,409	Klein	Oct. 12, 1915
1,612,281	Goetz	Dec. 28, 1926
1,752,582	Taylor	Apr. 1, 1930